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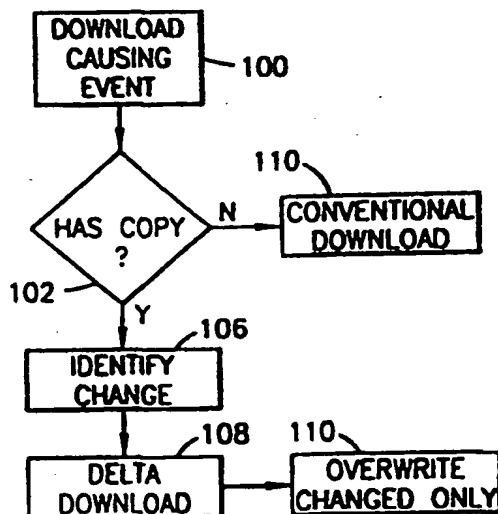
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(21) International Application Number: PCT/SE99/00612 (22) International Filing Date: 16 April 1999 (16.04.99) (30) Priority Data: 09/067,596 27 April 1998 (27.04.98) US (71) Applicant: TELEFONAKTIEBOLAGET LM ERICSSON (publ) [SE/SE]; S-126 25 Stockholm (SE). (72) Inventor: CAMERON, Duncan; 4985 Earncliffe Avenue, Montreal, Quebec H3X 2P4 (CA). (74) Agent: ERICSSON RADIO SYSTEMS AB; Common Patent Dept., S-164 80 Stockholm (SE).		(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG). Published <i>With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>

(54) Title: SELECTIVE SUBSCRIBER PROFILE DOWNLOAD FROM A PERSISTANT STORAGE NODE TO A TRANSIENT STORAGE NODE

(57) Abstract

In instances where an event (100) necessitates the downloading of a subscriber service profile from a persistent storage node, such as a home location register (16), to a transient storage node, such as a visitor location register (32) associated with a serving mobile switching center (22), a determination (102) is made as to whether the transient storage node already stores a copy of the service profile. If yes, an identification (106) is made of the information contained within the persistent storage node stored version of the service profile that have changed since the prior download. This changed information alone is then communicated (108) to the transient storage node in a delta download signaling message. The changed information is then used to overwrite (110) correspondingly tagged information that was previously stored in the transient storage node.



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**SELECTIVE SUBSCRIBER PROFILE DOWNLOAD
FROM A PERSISTENT STORAGE NODE
TO A TRANSIENT STORAGE NODE**

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BACKGROUND OF THE INVENTION

Technical Field of the Invention

The present invention relates to mobile telecommunications systems and, in particular, to the operation for downloading subscriber profile information from a first service node (such as a home location register) to a second service code (such as a visitor location register).

Description of Related Art

Reference is now made to FIGURE 1 wherein there is shown a block diagram of a portion of a telecommunications network 10 implementing a transaction-based interface (IF) 12 between a customer administrative system (CAS) 14 and a plurality of database network elements (NE) 16. The telecommunications network 10 comprises a mobile wireless (for example, cellular) communications system, and each database network element 16 comprises a home location register (HLR) database storing permanent and temporary wireless subscriber data. Alternatively, in an intelligent network (IN) implementation, the network element 16 may comprise a service control point (SCP). The permanent data stored in the database network element 16 comprises fixed information concerning the communications service subscribed to by each subscriber. The temporary data stored in the database network element 16 comprises variable information concerning the current location of each subscriber. The interface 12, customer administrative system 14, and database network elements 16 are interconnected using a network 18 preferably comprising a network, such as an X.25 network, separate and apart any other networks (such as, for example, the signaling system number seven (SS7) network) supporting calling operations within the telecommunications network 10.

The customer administrative system 14 is utilized to engage in transactions relating to the administration of the permanent data stored in each database network element 16. These administration activities, in general, relate to transactions performed for the purposes of customer (i.e., subscriber) creation or definition, service activation, and the like, relating to a given customer. More particularly, the transactions relate to subscriber data administration tasks such as:

- subscription initiation/removal/status,
- subscriber activation/cancellation,

- service provision/withdrawal/activation/passivation,
- C-number (transfer) definition,
- pass code changes, and
- serial number changes.

5 The transactions may further relate to authentication administration tasks such as authentication activation/change/deactivation/status. Additionally, the transactions relate to numbering plan configuration including number range assignment, numbering plan deletion and numbering plan viewing.

10 By "transaction-based" it is meant that the interface 12 receives orders originated at the customer administrative system 14 and directed (i.e., addressed) to a particular one of the database network elements 16, converts those commands to a proper format for communication to and/or understanding by the addressed database network element, and routes to the addressed database network element. Similarly, the interface 12 receives any response to the order from the addressed database network element 16, converts the response to a proper format for communication to and/or understanding by the customer administrative system 14 that originated the order, and routes to the originating customer administrative system.

20 The telecommunications network 10 further including a plurality of interconnected mobile switching centers (MSCs) 22. Although only two mobile switching centers 22 are shown, it will be understood that the network 10 likely includes many more interconnected nodes. The first and second mobile switching centers 22(1) and 22(2) may comprise any one of a number of known telecommunications switching devices, including those commonly used and known in the art for providing either digital or analog cellular telephone service to a plurality of mobile stations (MS) 24. The mobile switching centers 22 are interconnected with each other for communication via both voice trunks 28 (illustrated with broken lines) and signaling links 26 (illustrated with solid lines) providing a known ISUP (or R1 or R2) type connection. The voice trunks 28 provide voice and data communications paths used to carry subscriber communications between the mobile switching centers 22. The signaling links 26 carry command messages between the mobile switching centers 22. These messages may be used, for example, in setting up and tearing down voice and data communications links over the voice trunks 28 and controlling the provision of calling services to the mobile stations 24. Each mobile switching center 22 is also connected to at least one home location register database network element 16 through an associated visitor location register (VLR) 32 by means of a signaling link 34 providing a known Mobile Application Part (MAP) or IS-41 type connection. In an intelligent network implementation, the mobile switching center 22 (perhaps

along with its associated visitor location register 32) may comprise a service switching point (SSP).

5 The mobile switching centers 22 are further connected to a plurality of base stations (BS) 34 which operate to effectuate radio frequency communications with proximately located mobile stations 24 over the air interface 36. The mobile switching centers 22 function in a well known manner to control this radio frequency communications operation.

10 Although direct communications links (signaling and/or trunk) are illustrated in FIGURE 1, it is understood by those skilled in the art that the links are not necessarily direct between the illustrated nodes, and may instead pass through many other communications nodes (not shown) of the mobile network, and perhaps even utilize other communications networks (such as the public switched telephone network - PSTN). Illustration of the links in a "virtual" manner as shown in FIGURE 1 is therefore by way of simplification of the drawing and the communications relationship
15 between the various included nodes within the network 10.

For each cellular service subscription associated with a served mobile station 24, the database network element 16 stores service profile information 38 relating to cellular services and features subscribed to by the subscriber for that served mobile station. Generally, this service profile information is created (and subsequently
20 modified) by the operator through use of the customer administrative system 14 and its associated transactions relating to the administration of the permanent data, as described above.

When a mobile station 24 makes an initial registration with the system through a particular mobile switching center 22, that mobile switching center/service switching
25 point requests a subscriber service profile 38 relating to that mobile station, and its corresponding subscription, from the database network element 16. This subscriber service profile 38 information is then downloaded from the database network element 16 for storage in the visitor location register 32 associated with the mobile switching center/service switching point 22. Service for both in-coming and out-going calls is
30 then provided to the mobile station 24 by the serving mobile switching center 22 in accordance with the downloaded service profile 38.

The service profile 38 is downloaded from the database network element 16 in a number of different situations. First, the profile is downloaded at each instance when the subscriber activates a remote feature operation (such as, for example,
35 deactivation of call barring, activation of call forwarding, and deactivation of call waiting tone features). Second, the profile is downloaded at the request of the serving system (i.e., the mobile switching center/service switching point 22 or visitor location

register 32, such as, for example, at mobile station 24 registration). Third, the profile is downloaded in instances where the information in the database network element 16 comprising the service profile is modified by the operator through customer administrative system 14 command. Fourth, the profile is downloaded when automated cellular call service operations are initiated (such as, for example, automatic call barring or services that change profile based on time of day/day of week, etc. Fifth, the profile is downloaded in instances where service profile data is written into the database network element 16 from a service control point, another home location register or some other node of the network 10.

The service profile 38 for each subscriber contains a significant amount of important information. Each instance of a download conventionally necessitates the complete transmission of all of this information. With continued increases in the number of subscribers, and further as the size of the service profile itself continues to increase, the network activity (i.e., signaling message transmissions) required to support the downloading of subscriber service profiles imposes increasing demands and burdens on the telecommunications network 10. In particular, the communications resources allocated to carrying the downloaded service profile information may not be able to timely support both requests for profiles and other network operations. What is needed is a more efficient mechanism for conveying the service profile information from the database network element to another node of the network.

SUMMARY OF THE INVENTION

When a subsequent downloading of a subscriber service profile from a first service node to a second service node is required, an identification is made of the service profile information contained within the first service node that has changed since a prior download. A delta download signaling message is then sent from the first service node to the second service node solely containing the changed information. The information contained in the delta download signaling message then overwrites corresponding information that was previously stored in the second service node.

BRIEF DESCRIPTION OF THE DRAWINGS

A more complete understanding of the method and apparatus of the present invention may be acquired by reference to the following Detailed Description when taken in conjunction with the accompanying Drawings wherein:

FIGURE 1, previously described, is a block diagram of a portion of a telecommunications network;

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FIGURE 2 is a flow diagram of a procedure implemented by the network of FIGURE 1 for delta service profile download in accordance with the present invention;

FIGURE 3 is a representation of stored subscriber service profile information; and

5 FIGURE 4 is a format for the signaling message conveying changed service profile information.

DETAILED DESCRIPTION OF THE DRAWINGS

Reference is now made to FIGURE 2 wherein there is shown a flow diagram of a procedure implemented by the network of FIGURE 1 for delta service profile download in accordance with the present invention. In step 100, an event occurs which would necessitate a service profile download from a first service node (such as the home location register database or service control point) to a second service node (such as the visitor location register associated with the mobile switching center or service switching point). Such an event may, for example, comprise subscriber activation of a remote feature operation, a service profile download request by the serving system, modification of the information stored in the first service node by the operator through customer administrative system command, initiation of automated cellular call service operations, or the writing of service profile data into the first service node from another service control point, another home location register or some other node of the network. Responsive thereto, a determination is made in step 102 as to whether the second service node already has a copy of the service profile. If no, a conventional full service profile download, as in the prior art, is performed in step 104. If yes, meaning that a prior download of the service profile has previously occurred and the profile is still stored by the second service node, an identification is made in step 106 as to the portion of the stored service profile which has changed since that previous download occurred. Then, in step 108, solely that changed portion of the service profile is downloaded to the second service node. In the second service node, the received message is recognized as containing solely changed service profile information, and only that portion of the service profile which has changed is then overwritten in step 110 by the step 108 downloaded service profile information.

The downloading that occurs in step 108 in accordance with the present invention may utilize, for example, signals comprising modifications of the known IS-41 qualification request (qualreq) return result and qualification directive (QUALDIR) messages. Other known signaling messages, modified as necessary to support delta downloading in accordance with the present invention, may alternatively be utilized to convey the changed service profile information. Furthermore, new signaling

messages may alternatively be defined for the step 108 download to the second service node.

5 Reference is now made to FIGURE 3 wherein there is shown a representation of a subscriber service profile 38 as stored in the first service node. The service profile 38 comprises a plurality of pieces of information 70 relating to the subscriber. Each piece of information 70 comprises an identifying tag 72 which identifies the piece of information associated with a value 74 for that information.

10 Reference is now made to FIGURE 4 wherein there is shown a format for a delta download signaling message 80 conveying changed service profile information. The message 80, as discussed above, may comprise a modified existing message or a new message. The message 80 may include an indicator (I) 82 designating whether the downloaded service profile information contained in the message comprises a complete download or a partial download. The use of the indicator 82 is important in situations where the same message 80 is to be used by the first service node for all types of service profile downloads. In situations where a unique delta download message is supported, the indicator may not be required. The message further includes the changed portion 84 of the service profile information. To support second service node identification of which particular items of information 70 have changed, the conveyed changed portion 84 of the service profile information included within the message 80 comprises not only the value (V) 74 of each piece of information, but also its corresponding identifying tag (T) 72. With knowledge of the tag, 72, the second service node may properly overwrite the associated value following receipt of the delta download message 80.

20 Although preferred embodiments of the method and apparatus of the present invention have been illustrated in the accompanying Drawings and described in the foregoing Detailed Description, it will be understood that the invention is not limited to the embodiments disclosed, but is capable of numerous rearrangements, modifications and substitutions without departing from the spirit of the invention as set forth and defined by the following claims.

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WHAT IS CLAIMED IS:

1. A method for downloading service profile information from a first service node to a second service node of a telecommunications network, comprising the steps of:
 - 5 identifying the occurrence of a service profile downloading event;
determining a changed portion of the service profile information;
sending solely the determined changed portion of the service profile information from the first service node to the second service node; and
overwriting service profile information stored in the second service node with
10 that sent changed service profile information.
2. The method as in claim 1 wherein the step of identifying the service profile downloading event comprises the step of responding to receipt of a request for the service profile information from a mobile switching center.
3. The method as in claim 1 wherein the step of identifying the service
15 profile downloading event comprises the step of responding to an operator modification of the first service node stored service profile information.
4. The method as in claim 1 wherein the step of identifying the service profile downloading event comprises the step of responding to a subscriber activation of a remote feature operation.
- 20 5. The method as in claim 1 wherein the step of identifying the service profile downloading event comprises the step of responding to a subscriber initiation of an automated cellular call service operation.
6. The method as in claim 1 wherein the step of identifying the service profile downloading event comprises the step of responding to a writing of service
25 profile information into the first service node from another node of the telecommunications network.
7. The method as in claim 1 wherein the step of sending comprises the steps of:
 - 30 formatting a delta change message to included solely the changed portion of the service profile information; and

sending the delta change message from the first service node to the second service node.

35 8. The method as in claim 7 wherein the service profile information comprises an identifying tag with an associated value, and the step of formatting the delta change message comprises the step of including within the message for each changed portion of the service profile information its tag and value.

9. The method as in claim 8 wherein the step of formatting further comprises the step of including within the message an indicator identifying the message as containing solely changed portions of the service profile information.

40 10. The method as in claim 1 wherein the first service node comprises a home location register and the second service node comprises a visitor location register.

11. The method as in claim 1 wherein the first service node comprises a service control point and the second service node comprises a service switching point.

45 12. A mobile telecommunications network, comprising:
a first service node storing subscriber service profile information;
a second service node for storing visiting subscriber service profile information;

50 means for selectively downloading subscriber service profile information from the first service node to the second service node, said means identifying changed portions of first service node stored service profile information previously downloaded to the second service node and sending solely the identified changed portion of the service profile information from the first service node to the second service node during selective downloading.

55 13. The network as in claim 12 wherein the means for selectively downloading sends solely the identified changed portion of the service profile information in response to receipt of a request for the service profile information.

14. The network as in claim 12 wherein the means for selectively downloading sends solely the identified changed portion of the service profile

60 information in response to an operator modification of the first service node stored service profile information.

15. The network as in claim 12 wherein the means for selectively downloading sends solely the identified changed portion of the service profile information in response to a subscriber activation of a remote feature operation.

65 16. The network as in claim 12 wherein the means for selectively downloading sends solely the identified changed portion of the service profile information in response to a subscriber initiation of an automated cellular call service operation.

70 17. The network as in claim 12 wherein the means for selectively downloading sends solely the identified changed portion of the service profile information in response to a writing of service profile information into the first service node from another node of the mobile telecommunications network.

75 18. The network as in claim 12 wherein the service profile information comprises an identifying tag with an associated value, and the means for selectively downloading sends a delta change message including the tag and associated value for each identified changed portion of the service profile information.

19. The network as in claim 18 wherein the delta change message includes an indicator identifying the message as containing solely identified changed portions of the service profile information.

80 20. The network as in claim 12 wherein the first service node comprises a home location register and the second service node comprises a visitor location register.

21. The network as in claim 12 wherein the first service node comprises a service control point and the second service node comprises a service switching point.

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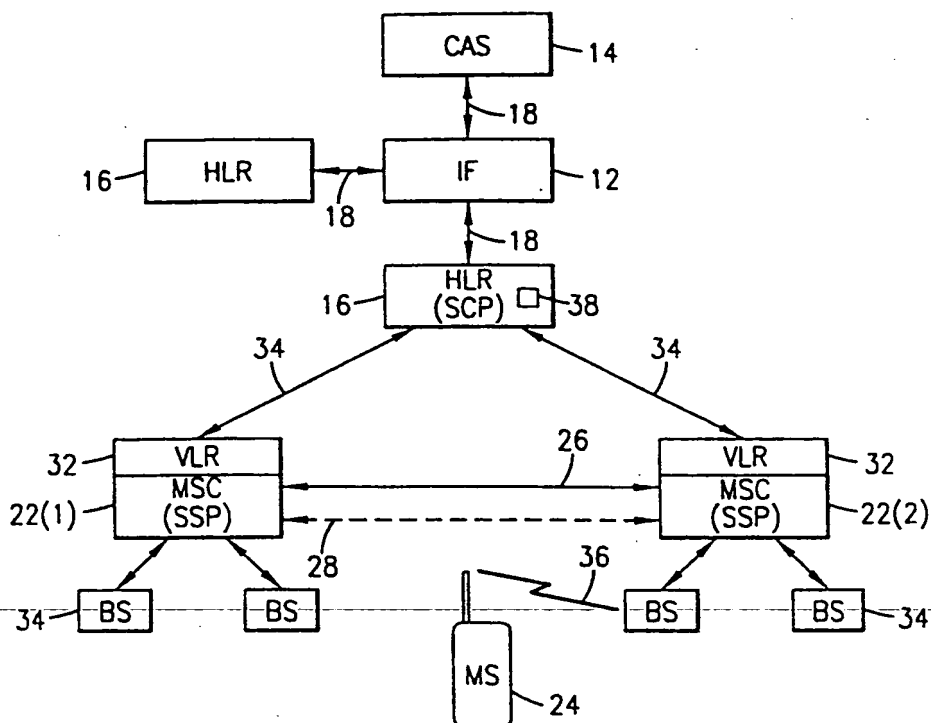


FIG. 1

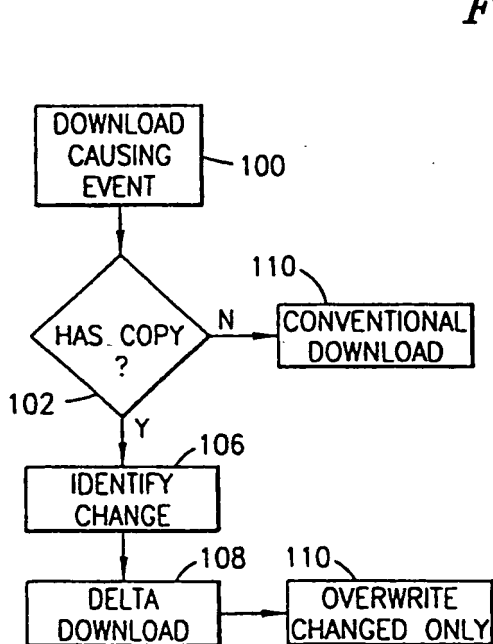


FIG. 2

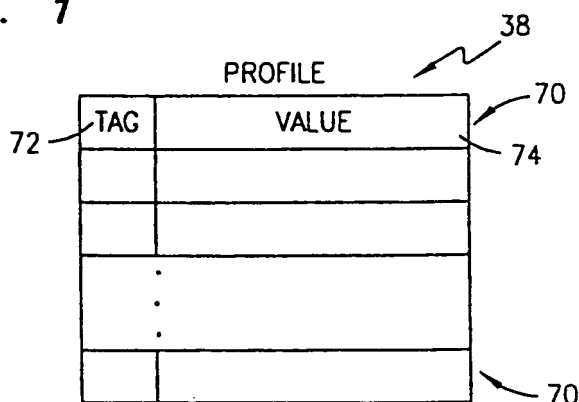


FIG. 3

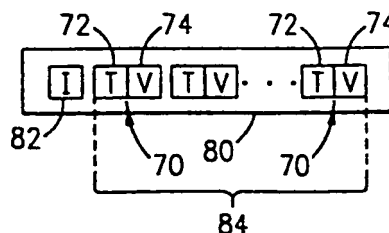


FIG. 4

INTERNATIONAL SEARCH REPORT

International Application No

PCT/SE 99/00612

A. CLASSIFICATION OF SUBJECT MATTER
 IPC 6 H04Q7/38 H04Q3/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 509 118 A (TUULOS MARTTI ET AL) 16 April 1996 (1996-04-16) column 1, line 42-58 column 3, line 22 -column 4, line 4 -----	1,3, 7-12,14, 18-21
A	WO 96 29838 A (NOKIA TELECOMMUNICATIONS OY ;PENTIKAEINEN JUKKA (FI)) 26 September 1996 (1996-09-26) page 6, line 15 -page 9, line 21 page 10, line 30 -page 16, line 2 -----	1-3, 8-14, 18-21

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Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/SE 99/00612

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